U.S. House of Representatives
Committee on Transportation and Infrastructure
Washington, DC 20515

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June 20, 2011

MEMORANDUM

TO: Members, Subcommittee on Aviation
Members, Subcommittee on Coast Guard and Maritime Transportation

FROM: The Honorable Thomas E. Petri, Chairman, Subcommittee on Aviation
The Honorable Frank LoBiondo, Chairman, Subcommittee on Coast Guard and Maritime Transportation

SUBJECT: Joint Hearing on GPS Reliability: A Review of Aviation Industry Performance, Safety Issues, and Avoiding Potential New and Costly Government Burdens, Thursday, June 23, 2011, at 9 a.m. in room 2167 Rayburn House Office Building.

PURPOSE

The Subcommittees on Aviation and the Coast Guard and Maritime Transportation will receive testimony from Federal government and industry witnesses regarding LightSquared's mobile broadband internet infrastructure plans and concerns with Global Positioning System (GPS) interference associated with those plans; the possible impacts on GPS reliability, NextGen, and aviation job creation; and the potential remedies to GPS interference.

BACKGROUND

GPS and LightSquared: Spectrum Neighbors

The Global Positioning System (GPS) is a space-based navigation system that provides position and timing information at any place on the globe with a high degree of accuracy. First developed by the military during the Cold War, President Ronald Reagan declared that GPS would be also made available for civilian use after Korean Air Lines flight 007 was shot down in 1983 for straying into Soviet airspace due to imprecise navigation.[1] All 269 people aboard the aircraft were killed, including then-sitting U.S. Congressman Lawrence McDonald. Subject to

[1] The Washington Post: "Now we know where we stand, and it's about time", Curt Suplee, November 3, 2009.

President Reagan's order, the Department of Defense (DoD) began to repurpose GPS for civilian use. GPS was made available for civilian use at its intended accuracy level, free of charge by Presidential Decision Directive NSTC-6 in 1996.[2] Since then, GPS has evolved into an important part of everyday life as new capabilities have developed. GPS functionality can be found in just about everything with an "on-off" switch, including cell phones, cars, Automated Teller Machines (ATM), farming equipment, and of course, aviation and maritime surveillance and navigation equipment.

The use of GPS in the aviation and maritime communities results in critical safety and efficiency benefits by providing highly reliable, more accurate position information compared to the legacy surveillance systems. In aviation, GPS will soon replace radar as the primary surveillance method and the Department of Transportation (DOT), the Federal Aviation Administration (FAA), and the United States Coast Guard (USCG) already utilize GPS technology in a broad variety of surveillance, navigation, safety, and efficiency applications.[3]

Billions of dollars of Federal and private-sector investment and millions of U.S. jobs are at stake in the future of GPS infrastructure. According to press accounts, the DoD investments into GPS have topped $35 billion since its introduction and continue at roughly $1 billion annually.[4] In addition, the FAA has invested $3.1 billion in GPS to date. FAA investments include:

- $1.7 billion in the Wide-Area Augmentation System, which will enhance the accuracy of GPS and permit aircraft to perform precision approaches in poor-visibility conditions;
- $1.1 billion in automatic dependent surveillance-broadcast (ADS-B), a GPS-based system for air traffic control that will ultimately replace controllers' use of radar to track aircraft in flight;
- $100 million in the implementation of performance-based navigation procedures, which allow aircraft to fly fuel-efficient routes and flight profiles, saving time, expense, and greenhouse gas emissions; and
- $200 million in the Ground-Based Augmentation System, which allows for more precise navigation after takeoff and on approach.

Additionally, the FAA's Capital Investment Plan calls for $2.2 billion of further investment in GPS-related NextGen systems until fiscal year 2013.[5] The FAA estimates by 2013, up to $10 billion of public and private sector investments will have been made in GPS. According to the FAA, over 360,000 civil aircraft are currently equipped with GPS-enabled avionics.[6] According to a recent study, the GPS industry supports over 3.3 million U.S. jobs annually. The direct

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[2] Presidential Decision Directive NSTC-6, The White House, March 28, 1996.
[3] GAO Report: Global Positioning System: Challenges in Sustaining and Upgrading Capabilities Persist, September 2010 (GAO-10-636).
[4] "LightSquared Plans Hinge on Outcome of GPS Interference Debate" by Peter B. de Selding, Space News International, March 4, 2011.
[5] Fed. Aviation Admin., *National Airspace System Capital Investment Plan, FY 2012-2016* (May 2011), *available at* http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/operations/sysengsaf/cip/files/FY12-16/FY12-16_CIP_Complete_May_2011.pdf.
[6] This figure includes 5,800 Passenger, Cargo, and Regional carriers, 2,800 International carriers, and 352,000 General Aviation and Air Taxi operators.

economic benefits of GPS technologies on commercial GPS users are estimated to be over $67.6 billion per year in the U.S. [7]

The Federal Communications Commission (FCC) is the independent federal agency, subject to Congressional oversight, with the responsibility to regulate interstate and international communications by radio, television, wire, satellite and cable. The FCC also oversees the allocation and use of telecommunications spectrum for government and private sector users. Radio spectrum is divided into bands with specific end points to each dedicated or allocated use. The common unit of measure on the radio spectrum is mega-hertz (MHz). GPS is one of many uses of radio spectrum, and its allocation is from 1560-1610 MHz. The FCC is led by Chairman Julius Genachowski, appointed by President Obama and sworn into office in June 2009.[8]

LightSquared

LightSquared Subsidiary LLC[9] (LightSquared) stated goal is to deliver more mobile broadband internet capacity. However, the location of the spectrum allocated to LightSquared by the FCC, and the resulting potential for disruption of GPS receivers, has stirred controversy among the GPS industry.

LightSquared plans to provide a wholesale, nationwide 4th-Generation ("4G") wireless broadband network integrated with satellite coverage. According to LightSquared representatives, the company has raised approximately $4 billion from capital investments, of which it has already spent $3 billion. LightSquared plans to invest a total of $14 billion over the next eight years to build out the network that it hopes to complete over the next five years. LightSquared executives expect to generate 15,000 jobs per year for each of the five years.[10] By contrast, the aviation industry accounts for approximately $1.2 trillion in annual economic impact, and contributes 11 million jobs to the U.S. economy.

LightSquared's network would be the first wholesale wireless 4G network. The company plans to sell services (i.e., access to its network) to retail companies that will provide services directly to consumers.

LightSquared intends to combine existing mobile satellite service (MSS)[11] with a ground-based wireless communications network of approximately 40,000 base stations that use the same "L-Band" radio spectrum as the satellites. Specifically, LightSquared is authorized by the Federal Communications Commission (FCC) as a MSS in the 1525-1559 MHz downlink band

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[7] "The Economic Benefits of Commercial GPS Use in the U.S. and the Costs of Potential Disruption" by ndp consulting. Author is Nam D. Pham, Ph.D. June 2011. According to the report, 3.3 million jobs rely on GPS technology. 130,000 in GPS manufacturing and 3.2 million in downstream commercial GPS intensive industries.

[8] www.fcc.gov

[9] LightSquared's predecessors include SkyTerra Communications, Mobile Satellite Ventures, Motient Services Inc. and the American Mobile Satellite Company.

[10] http://www.lightsquared.com/about-us/

[11] MSS is a radio communication service: (1) between mobile earth stations and one or more space stations, or between space stations used by this service; or (2) between mobile earth stations by means of one or more space stations. 47 C.F.R. § 2.1(c) (2011).

and 1626.5-1660.5 MHz uplink bands.[12] On Chart 1 (below), you can see that GPS's spectrum allocation between 1560-1610 MHz is immediately adjacent to LightSquared's downlink band.

It is worth noting that L-Band frequency has been historically reserved for low power communications between satellites and mobile earth stations.[13] According to the DoD, the frequency band 1525-1559 MHz was originally allocated exclusively for MSS Space-to-Earth signals (for example: Inmarsat and Iridium) and terrestrial systems were not permitted. Beginning in 2003, the FCC authorized terrestrial transmissions in the MSS band as Ancillary Terrestrial Component (ATC) transmissions, which were intended to fill in gaps in the coverage of satellite signals. The initial FCC MSS ATC service rules were designed to ensure that terrestrial parts of the networks remained truly ancillary and as mitigation for potential interference to other systems such as Inmarsat and GPS.[14]

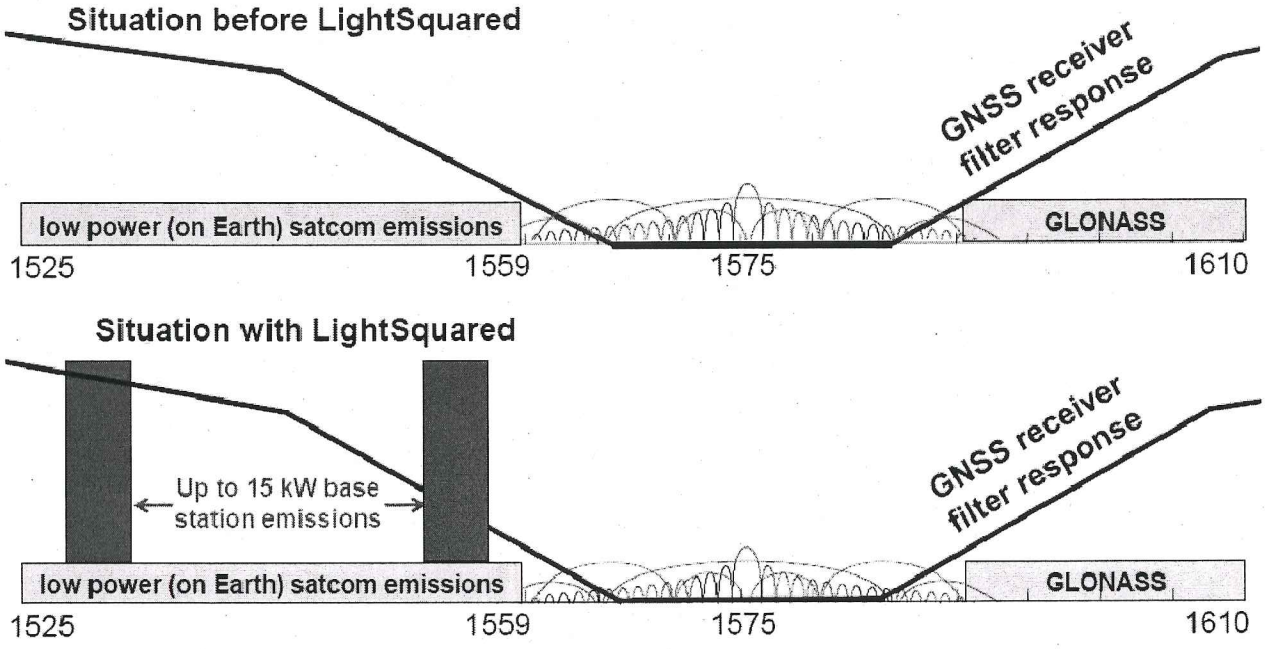

Chart 1: Illustration of Spectrum
Source: Position, Navigation, and Timing National Coordination Office (PNT NCO).

The possibility that LightSquared's ground-based transmissions may overpower the relatively weak GPS signal from space concerns the aviation and maritime users in the GPS community. Although LightSquared will operate in its own radio band, that band is so close to the GPS signals that many GPS devices could pick up the stronger LightSquared signal and become overloaded or jammed. Some are also concerned that the FCC may approve a technical solution to the problem that requires millions of existing GPS users to upgrade or replace their devices.

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[12] In 1989, the initial L-Band license was authorized to American Mobile Satellite Company and is currently held by LightSquared.

[13] "L-Band" broadly refers to the frequency range from one to two gigahertz, a portion of which is allocated for MSS operations. Specifically, 1525-1559 MHz is domestically and internationally allocated for transmission from satellites to mobile earth stations and 1610-1660.5 MHz for transmission from mobile earth stations to satellites.

[14] GPS Interference Information Paper, Office of the Secretary of Defense, March 11, 2011.

FCC AUTHORIZATIONS OF INTEGRATED SATELLITE-TERRESTRIAL BROADBAND

LightSquared's proposed 40,000 ground-based stations collectively form the ancillary terrestrial component (ATC) of its satellite network. As the ground-based component of a satellite broadband network, the ATC must ordinarily remain strictly supplemental – or ancillary – to the satellite-based MSS, under an FCC rule known as the integrated service rule.[15] In other words, the ground-based component should exist merely to fill in gaps in satellite coverage – not as the primary means of wireless broadband access for individual consumers. In authorizing integrated MSS/ATC services, the FCC has proceeded with the expectation that "MSS/ATC operators will only install ATC base stations in areas where the satellite signal is substantially affected. This would include where there is blocking or where consumers demand more communications paths than the satellite can provide. These are the precise situations for which [the FCC] authorized ATC."[16] LightSquared's authority to deploy a nationwide network of powerful ground-based stations transmitting in an area of the spectrum reserved for satellite communication evolved over a series of FCC orders.

2003 FCC Order

By order in 2003, the FCC first adopted rules providing for the deployment of integrated satellite and ground-based wireless broadband networks.[17] The FCC emphasized, in the order, the strictly ancillary nature of the ground-based component: "We do not intend, nor will we permit, the terrestrial component to become a stand-alone service. . . . As we have repeatedly indicated, we intend to authorize ATC only as an ancillary service to the provision of the principal service, MSS."[18]

At the time, the FCC recognized, on the basis of comments submitted by GPS stakeholders, that integrated satellite and ground-based networks would likely cause interference with aeronautical and other uses of GPS. The aviation and maritime policy concerns at issue in this hearing revolve around the likelihood that ground-based transmissions from LightSquared's terrestrial component will cause potentially irremediable interference with GPS receivers (the devices in aircraft and on marine vessels, among others, that receive and interpret relatively weak signals from GPS satellites). However, the majority of comments submitted to the FCC in the proceeding that culminated in the 2003 order tended to focus on a different technical issue: the effects of so-called out-of-band emissions (OOBE – i.e., emissions of radio signals that bleed into the frequencies used by GPS) that would emanate from the point of transmission.[19] In fact, at the time, LightSquared's predecessor company had already agreed to observe limitations on OOBE that were more stringent than existing limitations imposed by the FCC, which the predecessor company believed would mitigate the issue.[20]

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[15] 47 C.F.R. § 25.149(b)(4) (2011).

[16] *See In re Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands,* 20 FCC Rcd 4616, 4626 (F.C.C. 2005) (*Flexibility Order II).*

[17] *In re Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands; Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz* Bands, 18 FCC Rcd 1962 (F.C.C. 2003) (*Flexibility Order I).*

[18] *Id.* at 1965-66.

[19] *Id.* at 1965-66, 2028. (emphasis added)

[20] *See Amendment of Parts 2 and 25 to Implement the Global Mobile Personal Communications by Satellite (GMPCS) Memorandum of Understanding and Arrangements, Report and Order and Further Notice of Proposed Rulemaking,* 17 FCC Rcd 8903, 8936 (F.C.C. 2002) (establishing limitations on OOBE in general); *Flexibility*

2005 FCC Order

On multiple parties' petitions for reconsideration of the 2003 order, the FCC in 2005 issued a second order refining some of the technical requirements for deployment of integrated networks. The FCC outright eliminated a limit on the number of allowable terrestrial base stations that could be constructed as part of the ground-based component (the 2003 order imposed a restriction that would have effectively limited the number of LightSquared ATC base stations to 10,000 nationwide),[21] and it increased the permissible power level of ATC base stations,[22] thereby allowing companies such as LightSquared to deploy an unlimited number of ground base stations at higher power levels than previously permitted.

At the same time, the Commission declined to further address GPS interference, allowing that future rulemaking, if necessary, could "produce a more complete record upon which to establish final GPS protection limits for MSS ATC licensees."[23] Moreover, the Commission observed that it does not regulate GPS receivers and declined to premise an MSS licensure decision on the potential for interference with receivers.[24]

2011 Order

In 2010, LightSquared began to move forward with deployment of a ground-based component to supplement its existing MSS.[25] LightSquared sought in 2010, and received in 2011, a conditional waiver of the integrated service rule upon revealing that many of the end users of its network would be individual consumers who would use only the ground-based component, instead of the satellite and terrestrial services together, as required by the rule.[26] In other words, despite the supposedly "ancillary" nature of LightSquared's ground infrastructure, most of its retail customers would likely provide services to consumers who would utilize only the terrestrial portion of the network. The GPS industry has expressed concern that LightSquared's network, with transmissions in a band of frequencies reserved for satellite communications, will be used primarily for ground-based wireless access.

On January 26, 2011, the FCC conditioned a grant of LightSquared's waiver request on mitigation of GPS interference, which by then was known to include receiver-jamming, and directed a technical working group comprised of government and industry experts to submit periodic reports and recommendations. The group's final report was originally due on June 15, 2011, but the FCC, on LightSquared's motion, granted a two-week extension. The FCC is expected to solicit public comments before making a final decision on LightSquared's application for a waiver.

Order II, at 4641 (recounting LightSquared predecessor's voluntary agreement to observe more stringent OOBE limitations).

[21] *Flexibility Order II* at 4634; Flexibility Order I at 2037-38.

[22] *Flexibility Order II* at 4635-36.

[23] *Id.* at 4636.

[24] *Id.*

[25] *See In re SkyTerra Comms., Inc.*, 25 FCC Rcd 3059, 3089 (F.C.C. 2010).

[26] *See In re LightSquared Subsidiary LLC Request for Modification of its Authority for an Ancillary Terrestrial Component,* 26 FCC Rcd 566 (F.C.C. Jan. 26, 2011).

FCC final approval of the waiver would provide a more lucrative business model for LightSquared, in that its retail customers would have added flexibility to provide terrestrial-only service to consumers. Nevertheless, LightSquared has indicated that, regardless of the FCC's final decision on the waiver application, it is prepared to move forward with integrated MSS/ATC deployment.

Without the waiver, consumers would have to subscribe to integrated satellite and terrestrial wireless services, but interference with GPS receivers would occur regardless of whether end users subscribe to ground-only or to integrated satellite and ground components. So while the 2011 waiver has served to immediately galvanize and focus the attention of the GPS community on this issue, many in the GPS community also cite the earlier 2003 and 2005 orders originally authorizing LightSquared to deploy a terrestrial network in the L-Band as problematic and charge that the issue of GPS interference was never fully vetted. Many in the GPS community have expressed concern that the FCC's conditional waiver, coupled with its prior orders, effectively provides a backdoor for powerful terrestrial broadband services to be provided in a lower power portion of the spectrum reserved for satellite communications.

Interference Testing Results

A. The LightSquared Technical Working Group Report

Pursuant to the FCC's January 26, 2011, Order and Authorization, LightSquared conducted a series of tests in April 2011, in coordination with the GPS industry and government stakeholders, to evaluate the potential for GPS interference.

On June 15, 2011, the deadline for LightSquared to issue its Working Group report, LightSquared filed a request to the FCC for a two-week extension. GPS industry members of the Working Group expressed their opposition to the extension of the deadline, saying that the lion's share of data and analysis needed for the report has been completed and was ready for filing on time.[27] Nevertheless, the FCC granted LightSquared's request on the same day, setting a new deadline for LightSquared's report on interference and mitigation strategies of July 1, 2011.[28]

B. The RTCA, Inc. Report

Parallel to the Working Group established by LightSquared, the RTCA, Inc., a non-profit Federal Advisory Committee, conducted an independent evaluation of interference issues at the request of the Federal Aviation Administration (FAA). The RTCA report, submitted to the FAA on June 3, 2011, focused solely on aviation-related GPS impacts, details significant concerns with the LightSquared authorization.

According to the RTCA, the impact of LightSquared's proposed use of the upper channel of the LightSquared authorization "is expected to be complete loss of GPS receiver function." While the results of the study indicate that it could be possible to use the lowest 5 MHz wide

[27] Comments of the U.S. GPS Industry Council, June 15, 2011, FCC Docket number SAT-MOD-20101118-00239.
[28] FCC Decision: Grant Extension of Time, June 15, 2011, FCC Docket number SAT-MOD-20101118-00239.

channel without significant interference, the RTCA recommends that "from an aviation perspective, LightSquared upper channel operation should not be allowed."[29]

U.S. Government Concerns

A. GPS Reliability Issues Faced by the Department of Transportation (DOT):

Much of navigation and operation of transportation systems today are dependent on GPS. In the aviation sector, GPS also provides more accurate position information than legacy surveillance systems (including radar). With the higher degree of accuracy and precision offered by GPS for aeronautical surveillance and navigation, the safety of the national airspace system has been greatly improved. In addition, GPS usage within the aviation industry is widespread. According to the FAA, over 360,000 civil aircraft are currently equipped with GPS-enabled avionics.[30]

In its joint letter with the DoD, the DOT expressed concerns about how interference testing would be carried out by the Working Group, and how current and future LightSquared business plans might affect aviation safety and airspace modernization.[31] The Committee believes that the safety of flight concerns associated with GPS interference are paramount.

In addition to concerns regarding the effect of GPS reliability and interference on current operations, the DOT must also weigh potential negative impacts on the Department's NextGen program. For the past several years, the FAA has been implementing the DOT's planned modernization of the national airspace system, known as NextGen. The FAA's plans for NextGen include a transition from radar-based aircraft surveillance and management to a satellite-based system to achieve both safety and efficiency benefits. Billions of taxpayer and industry dollars have already been invested in the NextGen program. A chief concern at the DOT is that GPS interference problems might cause delays in much-needed NextGen benefits, or jeopardize the NextGen effort altogether.[32]

According to airline industry estimates, the U.S. airline industry has lost 160,000 jobs over the last ten years. Implementation of NextGen would create nearly the same amount of jobs nationwide over the next four years. If U.S. airlines were required to install filters and or replace GPS receivers on approximately 7,000 commercial aircraft to accommodate the LightSquared network, NextGen implementation would be delayed by up to ten years, thereby prohibiting this job growth.

The United States is also a signatory member of the United Nations' International Civil Aviation Organization (ICAO), an important institution to ensure international harmonization in aviation standards and regulations. The President and Secretary General of ICAO cosigned a letter to the FCC Chairman expressing concerns about the potential impact of GPS interference

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[29] Assessment of the LightSquared Ancillary Terrestrial Component Radio Frequency Interference Impact on GNSS L1 Band Airborne Receiver Operations, RTCA, Inc, June 3, 2011.

[30] This figure includes 5,800 Passenger, Cargo, and Regional carriers, 2,800 International carriers, and 352,000 General Aviation and Air Taxi operators.

[31] Deputy Secretary of Transportation John D. Porcari and Deputy Secretary of Defense William J. Lynn, III letter to FCC Julius Genachowski, March 25, 2011.

[32] According to the FAA, NextGen Programs at risk include ADS-B, RNP/RNAV, WAAS, LAAS, Cockpit Display of Traffic Information (CDTI), and Ground-Based Augmentation System (GBAS).

to current aviation operations, as well as modernization efforts underway in the United States and Europe.[33]

B. GPS Reliability Issues Faced by the United States Coast Guard and Maritime Industry:

Impact on Maritime Transportation

As with aviation, users of the marine transportation system are highly dependent on GPS. The vast majority of the 12 million recreational vessels, 30,000 fishing vessels, 40,000 commercial vessels, and 9,260 foreign vessels that call on U.S. ports rely on at least one, if not several GPS based systems for navigation, collision avoidance, and safety of life at sea.

The United States Coast Guard relies heavily on GPS data to successfully conduct its operations. The Coast Guard uses GPS technologies as the primary means of safely navigating its aircraft, cutters and small boats. In addition, the Service maintains several GPS dependent technologies which are essential to successfully conducting its search and rescue, environmental stewardship, drug and migrant interdiction, ice breaking, aids-to-navigation, ports and waterways security, and other missions.

During tests of the LightSquared signal, the Coast Guard has observed varying levels of interference with GPS signals. Depending on signal strength, frequency, distance, and terrain, the Service observed that the LightSquared signal could impact the following GPS dependent technologies:

1. *Automatic Identification System (AIS):* AIS is a very-high-frequency (VHF) line-of-sight system required by federal law and international standards to be carried on most commercial vessels. It enables the Coast Guard to track the movement of the vessels and helps the vessels themselves avoid collisions. It is dependent on position and timing information received by GPS satellites

2. *Differential GPS (DGPS):* DGPS augments the GPS system used by the Coast Guard and vessel operators to more precisely ascertain position using GPS receivers. Most recreational boaters rely on the signal provided from this system to hand held GPS devices to safely navigate. The Coast Guard uses the system for many of its operations including the setting of aids-to-navigation.

3. *Rescue21:* Rescue 21 is the Coast Guard's primary maritime distress system. It allows the Service to focus search and rescue efforts by determining a vessel's location based on a distress call over the radio. The system utilizes Digital Selective Calling to receive GPS position transmissions from vessels in distress. As such, it is dependent on both position and timing information received from GPS satellites.

4. *Search and Rescue Satellite-Aided Tracking (SARSAT):* SARSAT is a system of satellites that transmit distress calls and GPS position data from devices such as Emergency Position Indicating Radio Beacons (EPRIB) to the Coast Guard and other first responders. Most commercial vessels are required to carry EPIRBs under federal law.

[33] ICAO President and Secretary General letter to FCC Chairman Julius Genachowski, June 13, 2011.

5. *Vessel Management System (VMS):* VMS is as satellite-based system used to track commercial fishing vessels and ensure their compliance with restrictions on fishing locations. It relies on GPS for position and timing information to guide enforcement actions.

6. *Electronic Navigation Systems:* Federal law and international standards require all large commercial vessels to be equipped with electronic navigation systems. These vessels, as well as smaller commercial vessels and a sizeable portion of recreational vessels navigate solely using an electronic navigation system. These systems typically include an electronic charting system coupled with a GPS feed that shows the vessel's location on the chart, the direction of its motion, and its speed. While the charting function will still work without GPS, there would often be no way for a vessel to determine its position.

Back-Up System

Long Range Aids-to-Navigation (LORAN) was a VHF based position and timing system operated by the Coast Guard. It served as the primary means of electronic navigation for vessels and some aircraft from WWII until the advent of GPS, at which time it continued to operate as a back-up system. The FY 2010 Department of Homeland Security Appropriations Act (P.L. 111-83) gave the Coast Guard the authority to terminate the transmission of LORAN signals upon certification by the Commandant that termination of the signal would not adversely affect maritime safety and certification by the Secretary that LORAN infrastructure was not needed to house another system to act as a back-up to GPS. Those certifications were made and the signal was terminated on February 8, 2010. The Coast Guard has since begun to dismantle the system.

With the termination of the LORAN signal, DHS initiated a study to determine whether a back-up system is needed for GPS. Section 219 of the Coast Guard Authorization Act of 2010 (P.L. 111-281) required the Department to complete its determination as to whether a back-up system is needed by April 10th, 2011. The determination has still not been made, and at present, the Coast Guard and users of the marine transportation system remain reliant exclusively on GPS for geospatial data critical to navigation safety. Given the absence of a back-up system for maritime safety, GPS interference concerns posed by the LightSquared proposal are of particular concern to the Committee.

C. GPS Reliability Issues Faced by the DoD:

As the custodian of the GPS services, the DoD's primary concern is the continued availability and reliability of the GPS signal to Federal, commercial, and personal users. Specifically, the DoD is concerned the ground-based system will transmit a high-powered signal that will prevent GPS receivers from successfully receiving the GPS signal. According to the DoD, the increased signal via the ground network traffic for commercial mobile voice and Internet service will effectively appear like a GPS jammer and potentially degrade accuracy or cause a GPS receiver to completely lose lock. Potential harmful interference to GPS receivers from LightSquared could come in many forms, for example: Loss of Service due to GPS receiver

front end saturation due to insufficient filtering of ATC signals, or Loss of Accuracy as a result of loss of GPS signals.[34]

The Department's concerns apply to both civil and military receivers. DoD has also cited concerns with the FCC allocation processes and intergovernmental dispute resolution process.

Moving Forward: Potential Mitigation Strategies

Given the multiple government and industry reports of GPS interference issues posed by the LightSquared network proposal, LightSquared and GPS industry stakeholders have begun to discuss potential mitigation options to allow LightSquared to proceed with the roll-out of a mobile broadband network. Mitigation strategies being discussed include:

A. Filters

The disruptive interference posed to the GPS community results from high-powered transmissions within the range of spectrum that GPS receivers detect. In concept, a filter could prevent the interference by allowing the GPS receiver to only detect the GPS information, and filter out the high-powered neighboring signal.

Critics of this approach, however point to three major challenges. First, such filters have not been certified for use in aviation, and the standards-writing and certification process could take anywhere from ten to fifteen years to complete. Avionics manufacturers have also questioned the feasibility of designing such a filter. Second, adding new filtering equipment to aircraft would be expensive. The International Air Transport Association initial estimate put the potential cost to be between $2 billion and $7 billion for civil aviation alone. Costs would include the cost of the equipment coupled with associated labor and out of service costs. It is unclear who would be responsible for bearing the cost burdens associated with installing new filters. For government GPS retrofits, that cost would likely be borne by taxpayers. Were the FCC to allow LightSquared to proceed with this option, the new government burden falling on the fragile aviation industry could threaten job creation in the aviation industry. Finally, it is possible that filters could harm the fidelity of the position information or the ability to quickly lock onto satellite signals, thus limiting receivers' intended usefulness.

B. Limiting the Use of LightSquared's Allocated Spectrum

LightSquared's current plan calls for use of four channels of spectrum, each 10 MHz wide. Two of these channels would be used for uplink to satellites, and the other two channels would be used for downlink from the satellites. The two channels for proposed use in uplink currently do not pose any interference problems.

RTCA testing indicates that the two 10 MHz downlink channels within the satellite-purposed L Band of the spectrum, if used to the full terms of the FCC's January 26, 2011 conditional waiver authorization, would pose interference problems with GPS. Specifically, the higher of the two 10 MHz downlink channels is incompatible for use alongside GPS.

[34] GPS Interference Information Paper, Office of the Secretary of Defense, March 11, 2011.

However, according to the RTCA report, testing suggests that if LightSquared uses only a 5 MHz channel of its allocated spectrum that is furthest away from the GPS band, there would likely be no interference issues with aviation GPS receivers.[35] If LightSquared were to agree to such a limitation, they would be agreeing to only use roughly a quarter of their planned capacity. Further, while technical issues with GPS avionics receivers would likely be solved, other GPS functions (precision agriculture, architectural and construction surveying equipment, etc.) could still suffer interference.

C. Relocation of LightSquared Spectrum

The source of the interference problems posed by the LightSquared plan is the proximity of the spectrum allocated by the FCC for LightSquared's use to the spectrum that has long been allocated for use by GPS. A potential solution might be to relocate part of LightSquared's spectrum to another band. While demand for radio spectrum is high, a possible solution would be to swap spectrum allocations with a more GPS compatible spectrum holder. The FCC would have to oversee any such allocation swap.

Since LightSquared has not yet submitted the Working Group Report, there may be other mitigation strategies to be further explored.

[35] Assessment of the LightSquared Ancillary Terrestrial Component Radio Frequency Interference Impact on GNSS L1 Band Airborne Receiver Operations, RTCA, Inc, June 3, 2011.

Witnesses:

Panel I

The Honorable Roy Kienitz
Under Secretary for Policy
U.S. Department of Transportation

The Honorable Teri Takai
Acting Assistant Secretary for Networks and Information Integration
Chief Information Officer
U.S. Department of Defense

Rear Admiral Robert E. Day, Jr.
Assistant Commandant for Command, Control, Communications, Computers & Information Technology & Chief Information Officer
United States Coast Guard
U.S. Department of Homeland Security

Panel II

Ms. Margaret Jenny
President
RTCA, Inc.

Mr. Phil Straub
Vice President Aviation Engineering
Garmin International Inc.

Mr. Craig Fuller
President
Aircraft Owners and Pilots Association

Mr. Thomas L. Hendricks
Senior Vice President of Safety, Security and Operations
Air Transport Association

Mr. Jeffrey J. Carlisle
Executive Vice President, Regulatory Affairs and Public Policy
LightSquared